REMARKS

This Amendment is in response to the Office Action of November 2, 2004. In the Office Action, the Examiner indicated that Claims 1-33 are pending, Claims 29-33 are withdrawn from consideration, Claims 1-6, 8-22, 25-28 are rejected, and Claims 7, 23 and 24 are objected to.

With this Amendment, Claims 29-33 are indicated as withdrawn and Claims 1-33 are presented for reconsideration and allowance.

Elections/Restrictions

Applicant hereby confirms election of Group I Claims 1-28 for examination. Claims 29-33 are indicated to be withdrawn.

Claim Rejections - 35 USC 112

The Examiner rejected Claim 10 as indefinite under 35 USC 112 over the use of the "/" in "copper/iridium-manganese" and "tantalum/copper".

A person skilled in the art of thin film deposition would have known that seed layers can include multiple sublayers of differing composition and that the symbol "/" is used to represent a boundary between such multiple sublayers. Examples of use of "/" to represent boundaries between multiple sublayers can be found in US 6,518,668 at column 7, lines 17-20 and also at "References Cited", page 2, left column, lines 29-32: "Barrier Capabilities of Selective Chemical Vapor Deposited W Films and WSiN/WSi_x/W Stacked Layers Against Cu Diffusion" by M.T. Wang et al., J. Electrochemical Soc., vol. 146(2), Feb 1999, pp. 728-731.

Reconsideration and withdrawal of the objections under 35 USC 112 are therefore requested.

<u>Claim rejections - 35 USC 103</u>

The Examiner rejected Claims 1-6, 8-22, and 25-28 under 35 USC 103(a) over Carey et al. (US 2003/0022023) in view of Shimizu (US 2002/0004148).

In making the rejection, the Examiner indicated that Carey et al. showed the features of Claim 1 except for texturing of the soft magnetic underlayer to provide circumferential easy axis orientation. The Examiner indicated that Shimizu et al. teaches circumferentially texturing and considered it obvious to provide circumferential texture to a substrate as taught by Carey. The Examiner also indicated that "With respect to the claim limitation directed to a magnetic moment greater than 1.7 T, it is the Examiner's contention that the Fe65Co35 soft magnetic layers taught by Carey et al. inherently satisfy this limitation by virtue of the fact that magnetic moment is a material property and Applicants teach using the same material."

The Examiner refers to "the Fe65Co35 soft magnetic layers taught by Carey et al." However, a careful reading of the complete text and drawings of Carey et al. reveals no mention or suggestion of "Fe65Co35 soft magnetic layers". The Examiner is requested to either point out a disclosure of Fe65Co35 soft magnetic layers in Carey et al. or to withdraw the assertion that Carey et al. teaches Fe65Co35 layers.

The Examiner also contends that "magnetic moment is a material property." Magnetic properties of soft magnetic materials are not determined solely by material composition, but are also determined by processing conditions such as temperatures and magnetic fields during deposition processes and heat treating processes of the soft magnetic material. See, for example, Table 2.15 "Properties of Soft Ferromagnetic Magnetic Materials" (enclosed with this Amendment) on pages 2-92 through 2-97 in <u>Electronic Designers' Handbook</u>, Second Edition, L. J. Giacoletto,

Editor, McGraw-Hill Book Company (1977), ISBN 0-07-023149-4, particularly Note 3 on page 2-97 which states:

> "3. For optimum magnetic properties the materials must be carefully heat-treated after fabrication. This generally involves annealing in a controlled atmosphere (N2 = nitrogen, H2 = hydrogen) and controlled cooling (Q = quenching, C = controlled cooling rate) frequently in the presence of a magnetic field."

For a person skilled in the art to optimize process conditions for the applicant's claimed characteristic of "a magnetic moment larger than 1.7 teslas" would require knowledge gained from the present disclosure, in other words, it would require hindsight.

Carey et al. thus does not teach or suggest "Fe65Co35 soft magnetic layers", and also does not teach or suggest "a magnetic moment larger than 1.7 teslas."

Shimizu et al '148 also does not teach or suggest either "Fe65Co35 soft magnetic layers" or "a magnetic moment larger than 1.7 teslas."

The Examiner's contention that magnetic layers taught by Carey et al. satisfy the 1.7 T limitation is thus believed to be traversed.

The Examiner cited Shimizu et al. as showing texturing of a soft magnetic underlayer to provide circumferential easy axis orientation. The Examiner indicated that Shimizu et al. teaches circumferentially texturing and considered it obvious to provide circumferential texture to the substrate taught by Carey.

Shimizu et al. teaches texturing of a substrate, but Claim 1 includes a feature of "the soft magnetic layer having a texture." Texturing the substrate is not the same as texturing the soft magnetic layer. Carey does not teach or suggest that texturing the substrate will also texture the soft magnetic layer. As disclosed in the present specification at page 10, lines 13-14,

"The soft magnetic underlayer is preferably textured by using a seed layer to induce the texturing."

Neither Carey et al. nor Shimizu et al., taken singly or in combination, teach or suggest a magnetic recording medium as presently claimed in Claim 1. In particular, neither Carey et al. nor Shimizu et al. teach or suggest a magnetic moment larger than 1.7 teslas, and also do not teach or suggest texturing of a soft magnetic layer.

Reconsideration and allowance of rejected Claims 1-6, 8-22, 25-28 is therefore requested.

Allowable Subject Matter

The Examiner indicated that Claims 7 and 23-24 were objected to as being dependent on a rejected base claim, but otherwise allowable. As explained above, the base claims are believed to be allowable. Withdrawal of the objection, and allowance of Claims 7, 23-24 is therefore requested.

Information Disclosure Statement

Applicant notes that references AL, AM at the bottom of an IDS Form PTO 1449 that was filed with the application were not initialled by the Examiner. Applicant requests acknowledgement of these references.

The Application appears to be in condition for allowance and favorable action is requested.

The Director is authorized to charge any fee deficiency required by this paper or credit any overpayment to Deposit Account No. 23-1123.

Respectfully submitted,

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TABLE 2.15 Properties of Soft Ferromagnetic Magnetic Materials (*Note* 1) *

No.	Material	Description (*Note* 2)	Density ρ_M, kg/m^3	Thermal conductivity λ_θ, W/(K m)	Coefficient of linear thermal expansion, $\alpha_{\Delta x} \times 10^6$, (K)$^{-1}$	Tensile strength, $S \times 10^{-8}$, N/m^2	Tensile modulus, $E_Y \times 10^{-10}$, N/m^2	$\left(\frac{\text{Melt. temp.}}{\text{Anneal. temp.}}\right)$, °C (*Note* 3)	Curie temp. T_C, °C (*Note* 4)	Resistivity ρ, Ωm (*Note* 5)
1	Iron, Fe	0.9995 Fe, body-centered cubic single crystal	7,880	78	11.7	5.4–6.2	21.14	$\frac{1539}{1482\ H_2 + 880}$	770	1.0×10^{-7}
2	Iron, Fe	99.8% Fe	7,880	78	11.7	5.4–6.2	21.14	$\frac{1536.5}{950}$	770	1.0×10^{-7}
3	Iron, Fe	Mild steel, 0.2% C	7,859	78	11.7	3.1		$\frac{1523}{950}$	770	1.0×10^{-7}
4	Nickel, Ni	99% Ni, face-centered cubic single crystal	8,902	89	12.8	5.0–9.0	19.95	$\frac{1453}{1000}$	358	7.06×10^{-8}
5	Cobalt, Co	99% Co, hexagonal single crystal	8,850	97	12	2.6–7.5		$\frac{1492}{1000}$	1115	5.86×10^{-8}
6	Silicon-iron	3% Si, cube on edge	7,650	18.0		∥ 3.0 ⊥ 3.0	∥ 11 ⊥ 11	$\frac{1488}{800\ N_2}$	740	4.7×10^{-7}
7	Silicon-iron	3% Si, oriented, Silectron, AISI Grade M-5	7,650	18.0		∥ 3.0 ⊥ 3.2	∥ 11 ⊥ 19	$\frac{1488}{800\ N_2}$	740	4.7×10^{-7}
8	Silicon-iron	3% Si, oriented, Silectron, AISI Grade M-6	7,650	18.0		∥ 3.0 ⊥ 3.2	∥ 11 ⊥ 19	$\frac{1488}{800\ N_2}$	740	4.5×10^{-7}
9	Silicon-iron	3% Si, oriented, Silectron, AISI Grade M-7	7,650	18.0		∥ 3.0 ⊥ 3.2	∥ 11 ⊥ 19	$\frac{1488}{800\ N_2}$	740	4.7×10^{-7}
10	Silicon-iron	2.85 to 3.25% Si, Trans. C nonoriented, AISI Grade M-19	7,550	16.3		4.0–4.2	0.63	$\frac{1488}{870\ N_2}$	732	5.4×10^{-7}
11	Silicon-iron	2.7 to 3.1% Si, Dynamo Special non-oriented, AISI Grade M-22	7,650	18.0		3.9–4.1		$\frac{1488}{870\ N_2}$	732	4.6×10^{-7}
12	Silicon-iron	2.5 to 2.9% Si, Dynamo Grade non-oriented, AISI Grade M-27	7,650	19.7		3.7–3.8		$\frac{1480}{870\ N_2}$	732	4.5×10^{-7}
13	Silicon-iron	1.7 to 2.3% Si, Electrical Grade non-oriented, AISI Grade M-36	7,750	30.5		3.4–3.5		$\frac{1506}{870\ N_2}$	735	3.7×10^{-7}
14	Silicon-iron	1.5 to 2.0% Si, Armature Grade non-oriented, AISI Grade M-43	7,750	40.6		3.2–3.3		$\frac{1510}{870\ N_2}$	737	2.8×10^{-7}
15	Silicon-iron	2.25% Si, Relay Grade 5 nonoriented	7,650		11.6	5.3		$\frac{1502}{1000\ H_2}$	749	4.0×10^{-7}

16	Steel	1% C	7,830	45.1	12.4	13.8		$\frac{1465}{870\ N_2}$	770	1.2×10^{-7}
17	Aluminum-iron	3.5% Al	7,460					$\frac{1536}{1100}$	750	5.5×10^{-7}
18	Aluminum-iron	13% Al, Alfer	6,660			4.8		$\underline{1515}$	510	9.0×10^{-7}
19	Aluminum-iron	16% Al, Alperm	6,500			6.1		$\frac{1500}{600\ Q}$	400	1.4×10^{-6}
20	Nickel-iron	30% Ni, Thermoperm		11.0	3.4			$\frac{1460}{1000}$	417	
21	Nickel-iron	36% Ni, Hyperm 36	8,150	1.0	0.88	4.8		$\underline{1450}$	417	6.5×10^{-7}
22	Nickel-iron	45% Ni, 45-Permalloy	8,170	15.9	8.4	5.0		$\frac{1440}{1050}$	480	4.5×10^{-7}
23	Nickel-iron	50% Ni, Hipernik	8,250	15.5	9.5	5.0		$\frac{1438}{1200\ H_2}$	500	4.5×10^{-7}
24	Nickel-iron	50% Ni, Deltamax	8,250	15.5	8.4	4.4	15.2	$\frac{1438}{1075\ H_2 + C}$	500	4.5×10^{-7}
25	Nickel-iron	50% Ni, 50-Isoperm	8,250	15.5	9.0	4.0		$\frac{1438}{1100}$	500	4.0×10^{-7}
26	Nickel-iron	78.5% Ni, 78-Permalloy	8,600		12.5	4.8		$\frac{1440}{1050 + 600\ Q}$	600	1.6×10^{-7}
27	Cobalt-iron	50% Co, Permendur	8,300		11.0			$\frac{1485}{800}$	980	4.0×10^{-7}
28	Molybdenum-iron	3% Mo, Moly-Iron	7,900		11.5	3.0			805	2.0×10^{-7}
29	Sendust	10% Si + 5% Al	8,800					$\overline{\text{As cast}}$	500	6.0×10^{-7}
30	36 Isoperm	36% Ni + 9% Cu	8,200						300	7.0×10^{-7}
31	Radio-Metal	45% Ni + 5% Cu	8,300					$\overline{1050}$	530	5.5×10^{-7}
32	Sinimax	43% Ni + 3% Si	7,700					$\overline{1125\ H_2}$		8.5×10^{-7}
33	Monimax	48% Ni + 3% Mo	8,270					$\overline{1125\ H_2}$	400	8.0×10^{-7}
34	45-25 Perminvar	45% Ni + 25% Co						$\overline{1000 + 400}$	715	1.9×10^{-7}

* *Notes* appear on page 2-97.

TABLE 2.15 Properties of Soft Ferromagnetic Magnetic Materials *(continued)*

No.	Material	Description (*Note* 2)	Density ρ_M, kg/m³	Thermal conductivity λ_θ, W/(K m)	Coefficient of linear thermal expansion, $\alpha_{\Delta x}$ × 10⁶, (K)⁻¹	Tensile strength, $S \times 10^{-8}$, N/m²	Tensile modulus, $E_Y \times 10^{-10}$, N/m²	$\left(\frac{\text{Melt. temp.}}{\text{Anneal. temp.}}\right)$, °C (*Note* 3)	Curie temp. T_C, °C (*Note* 4)	Resistivity ρ, Ωm (*Note* 5)
35	Megaperm 6510	65% Ni + 10% Mn								5.8×10^{-7}
36	7-70 Perminvar	70% Ni + 7% Co	8,600						650	1.6×10^{-7}
37	Cr-Permalloy	78.5% Ni + 3.8% Cr	8,500					$\frac{}{1000 + 425}$	420	6.5×10^{-7}
38	4-79 Permalloy	79% Ni + 4% Mo	8,740			4.4	17.2	$\frac{}{1000}$	460	5.5×10^{-7}
39	Supermalloy	79% Ni + 5% Mo	8,770					$\frac{}{1100\ H_2 + C}$	400	6.0×10^{-7}
40	Superperminvar	22.8% Co + 9% Ni						$\frac{}{1300\ H_2 + C}$		
41	Hiperco	35% Co + 0.5% Cr	8,000					$\frac{}{\text{Low temp.}}$	970	2.0×10^{-7}
42	Vanadium Permendur	49% Co + 2% V	8,150		9.2	6.2	24.1	$\frac{1490}{850}$	980	4.0×10^{-7}
43	Mumetal	77% Ni + 5% Cu + 2% Cr	8,580		12.5	4.4	17.2	$\frac{1485}{840\ N_2}$	400	6.2×10^{-7}
44	Superpermalloy	78.1% Ni + 2.9% Cr + 2.5% Sn						$\frac{}{1175\ H_2 + C}$		6.1×10^{-7}
45	1040	72% Ni + 14% Cu + 3% Mo	8,760					$\frac{}{1100\ H_2}$	290	5.6×10^{-7}

TABLE 2.15 Properties of Soft Ferromagnetic Magnetic Materials *(continued)*

No.	Initial relative perme-ability κ_{mi} (*Note* 6)	Maximum relative perme-ability $\kappa_{m,\max}$ (*Note* 6)	H_0 (H at $\mu_{\max}$), A/m (*Note* 6)	B_0 (B at $\mu_{\max}$), teslas (*Note* 6)	H_S, A/m (*Note* 6)	B_S, teslas (*Note* 6)	Reten-tivity M_{rs}, teslas (*Note* 6)	Coer-civity H_{cs}, A/m (*Note* 6)	$-(B_d H_d)_{\max}$, J/m³	Ray-leigh con-stant η_R, H/A	Stein-metz con-stant η_S, J/(m³ Tⁿ)	Stein-metz expo-nent n	Hys-teresis loop energy W_h/V, J/m³
1	1.0×10^4	[100] 2.9×10^5 [110] 2.1×10^5 [111] 1.8×10^5	5.5	[100] 1.97 [110] 1.45 [111] 1.22	[100] 13.5 [110] 47.8 [111] 43.8	2.158	1.6	4	5.6	3.14×10^{-5}	300	1.6	30
2	150	5×10^3			7×10^4	2.15		79.5		3.14×10^{-5}			500
3	120	2×10^3	280	0.70		2.12	0.72	143	500	3.14×10^{-5}			500
4	220	[111] 645 [110] 530 [100] 380	520	[111] 0.42 [110] 0.35 [100] 0.25	[111] 4×10^3 [110] 2×10^4 [100] 2.8×10^4	0.62	0.3	56		3.90×10^{-6}			200
5	[0001] 70 [1010] 3	[0001] 250 [1010] 3	[0001] 4.8×10^3 [1010] 7.9×10^4	[0001] 1.5 [1010] 0.3	[0001] 1.5×10^5 [1010] 8.0×10^5	1.79		797		1.62×10^{-7}			200
6	∥1.5×10^3 ⊥1.5×10^3	∥5.0×10^4 ⊥5.0×10^4	∥14.3 ⊥14.3	∥0.9 ⊥0.9	∥1.95×10^4 ⊥1.95×10^4	∥2.00 ⊥2.00	∥1.5 ⊥1.5						
7	∥1.5×10^3	∥5.0×10^4	∥14.3	∥0.9	∥1.95×10^4	∥2.00	∥1.5	∥9.5			∥3.98×10^3	∥1.86	143
8	∥350	∥4.7×10^4	∥15.2	∥0.9	∥7.16×10^3	∥1.97	∥1.4	∥7.9	∥5.9		∥4.70×10^3	∥1.86	108
9						∥2.01					∥5.15×10^3	∥1.86	
10	300	7.2×10^3	71.5	0.63	3.96×10^4	1.96	0.72	42	10.5	2.4×10^{-2}			160
11	290	6.6×10^3	79.6	0.66	3.18×10^4	1.97	0.730	43	11.5				
12	290	6.0×10^3	87.5	0.65	3.42×10^4	1.98	0.735	43	11.5				
13	280	5.5×10^3	119	0.82	3.34×10^4	1.99	0.903	56	18.5				
14	280	5.0×10^3	127	0.80	3.74×10^4	2.03	0.880	72	21.0				
15		6.7×10^3	107	0.90	3.58×10^4	2.04	0.860	61	21.0				
16	200	3.8×10^3	157	0.75	5.0×10^4	2.00	0.95	600	1.4	1.6×10^3			
17	500	1.9×10^4	40	0.95		1.90		24					
18	700	3.7×10^3				1.20		53					
19	3.0×10^3	5.5×10^4				0.80		3.2					150
20						0.20							
21	2.5×10^3	2.0×10^4				1.3		8					
22	2.5×10^3	2.5×10^4			4.0×10^3	1.6		23.9		2.52×10^{-4}			120
23	4.0×10^3	7.0×10^4	3.5	0.32		1.6	1.45	4.0					22
24	500	1.5×10^5	3.4	0.53	800	1.55	0.95	5.5	8.2	1.38×10^{-3}	13	1.77	33
25	90	100				1.60		480					
26	8.0×10^3	1.0×10^5				1.08		4.0					58
27	800	5.0×10^3	480	1.2	8.0×10^3	2.45	1.6	160					1.2×10^3
28		6.0×10^3	126	0.98	3.3×10^4	2.07	1.17	60.5					426

TABLE 2.15 Properties of Soft Ferromagnetic Magnetic Materials *(concluded)*

No.	Initial relative perme-ability κ_{mi} (*Note* 6)	Maximum relative perme-ability $\kappa_{m,\max}$ (*Note* 6)	H_0 (H at $\mu_{\max}$), A/m (*Note* 6)	B_0 (B at $\mu_{\max}$), teslas (*Note* 6)	H_S, A/m (*Note* 6)	B_S, teslas (*Note* 6)	Reten-tivity M_{rs}, teslas (*Note* 6)	Coer-civity H_{cs}, A/m (*Note* 6)	$-(B_d H_d)_{\max}$, J/m^3	Ray-leigh con-stant η_R, H/A	Stein-metz con-stant η_S, J/(m^3 T^n)	Stein-metz expo-nent n	Hys-teresis loop energy W_h/δ, J/m^3
29	3.0×10^4	1.2×10^5				1.00		4.0					10
30	60	65						478					
31	2.0×10^3	2.0×10^4				1.56	0.4	31.8					110
32	3.0×10^3	3.5×10^4	12.3	0.54		1.1	0.55	7.9					40
33	2.0×10^3	7.5×10^4	6.0	0.55		1.45	0.89	7.9			50	1.9	80
34	400	2.0×10^3	320	0.8	5.6×10^3	1.55		95.6		1.6×10^{-9}			250
35	4.8×10^2	2.6×10^4	7.3	0.24		0.86		6.4					
36	850	4.0×10^3				1.25		4.8					
37	1.2×10^4	6.2×10^4			800	0.80		4.0					
38	2.0×10^4	3.3×10^5	0.7	0.28	1.4×10^3	0.87	0.65	4.0	2.08	5.4×10^{-3}	17.6	1.9	20
39	1.0×10^5	1.0×10^6	0.32	0.40		0.79	0.45	0.16		0.188			0.8
40	63.5												
41	650	1.0×10^4				2.42		80					330
42	800	8.0×10^3	129	1.4	8.0×10^4	2.4	2.14	25	56		224	3.6	600
43	2.0×10^4	2.9×10^5	0.64	0.24		0.65	0.32	4.0	1.42		44	1.9	4.0
44	2.4×10^4	8.0×10^4											
45	4.0×10^4	1.0×10^5	1.8	0.23	80	0.6	0.24	1.6					20

Notes to Table 2.15.

1. The units indicated apply to the quantity tabulated when the values in the column are *divided* by the common factor, if any, shown at the column heading. Properties are mostly compiled from the following sources:

(*a*) Richard M. Bozorth, *Ferromagnetism*, D. Van Nostrand Company, Inc., Princeton, N.J., 1951.

(*b*) R. Ochsenfeld and K. H. v. Klitzing, Magnetische Werkstoffe, sec. 445, pp. 737–843 of group 6, vol. IV, part 3, Landolt-Börnstein, *Zahlenwerte und Functionen as Physik, Chemie, Astromie, Geophysik und Technik*, Ernst Schmidt (ed.), Springer-Verlag OHG, Berlin, 1957.

(*c*) Commercial literature.

Data as tabulated are for materials at room temperature (about 25°C).

2. For significance of American Iron and Steel Institute (AISI) designations, see ASTM A 345-55, Standard Specifications for Flat-Rolled Electrical Steel, pp. 73–76 of part 8, *1973 Annual Book of ASTM Standards*, American Society for Testing and Materials, Philadelphia, 1973. Weight percentages are indicated with the balance as iron.

3. For optimum magnetic properties the materials must be carefully heat-treated after fabrication. This generally involves annealing in a controlled atmosphere (N_2 = nitrogen, H_2 = hydrogen) and controlled cooling (Q = quenching, C = controlled cooling rate) frequently in the presence of a magnetic field.

4. Above the Curie temperature the material no longer exhibits residual magnetic polarization.

5. For measurement method see ASTM B 193-722, Standard Method of Test for Resistivity of Electrical Conductor Materials, pp. 227–232 of part 8, *op. cit.*

6. Standard methods of measurement are described in part 8, *1973 Annual Book of ASTM Standards, op. cit.* See also Raymond L. Sanford and Irvin L. Cooter, Basic Magnetic Quantities and the Measurement of the Magnetic Properties of Materials, National Bureau of Standards Monograph 47, May 21, 1962, pp. 439–476 of *NBS Spec. Publ.* 300, vol. 3, Precision Measurement and Calibration, U.S. Government Printing Office, Washington, D.C., December 1968.